1.0 Introduction

On August 22, 2000, an employee working on an Environmental Management (EM) Technology Deployment Project received serious burns from a chemical reaction, which required hospitalization. On August 23, 2000, Leah Dever, Manager, U.S. Department of Energy Oak Ridge Operations (DOE ORO), appointed a Type B Accident Investigation Board (referred to as "the Board") to investigate the accident in accordance with DOE Order 225.1A, *Accident Investigations* (see Appendix A). The Board arrived on site on August 23, 2000. This report documents the facts surrounding the accident and the results and conclusions of the Board.

1.1 Facility Description

The Portsmouth Gaseous Diffusion Plant (PORTS) is located approximately 25 miles northeast of Portsmouth, Ohio, and about two and a half miles east of the Scioto River. The PORTS site is approximately 3,714 acres. The fenced area surrounding the gaseous diffusion plant facilities occupies about 640 acres. The DOE mission at PORTS was to enrich uranium for use in domestic and foreign commercial power reactors. In the past, the mission also included providing materials for weapons production and naval reactor fuel. In the fall of 1992, the Energy Policy Act (Public Law 102-486) amended the Atomic Energy Act of 1954 and established the United States

Exhibit 1-1. PORTS X-701B Site

Enrichment Corporation (USEC). USEC assumed responsibility for uranium enrichment operations at PORTS on July 1, 1994. The Nuclear Regulatory Commission performs regulatory oversight of USEC activities. The Occupational Safety and Health Administration (OSHA) regulates USEC occupational safety and worker health, and the State of Ohio and Environmental Protection Agency (EPA) regulates USEC environmental activities.

DOE remains the owner of the site and is responsible for all facilities not leased to USEC and for all environmental response and corrective actions with respect to contamination or releases arising from past operations. Bechtel Jacobs Company LLC (BJC) became the prime management and integration (M&I) contractor for DOE at PORTS on April 1, 1998.

The accident occurred outside the limited area of PORTS, near the north end of the perimeter fence and just east of the PORTS perimeter road near the intersection of the east access road (see Exhibit 1-1). The task in progress was a technology deployment project being performed by another DOE ORO prime contractor, UT-Battelle, LLC (UT-Battelle), for the DOE ORO Environmental Technology Group. Field operations were being done by IT Corporation (IT), under subcontract to UT-Battelle. IT was supported on site by personnel from two second-tier subcontractors, Miller Drilling and FRx Corporation (FRx).

The pilot-scale project being deployed at the time of the accident was in-situ chemical oxidation using lance permeation delivery of sodium permanganate ($NaMnO_4$) (permanganate). The lance permeation injection process uses high-pressure water and low-pressure permanganate solution. High-pressure water is used to fracture the ground formation and dilute the permanganate solution. The permanganate solution reacts with the trichloroethene (TCE), thereby achieving TCE plume reduction and treatment.

1.2 Scope, Purpose, and Methodology

The Board began the investigation on August 23, 2000, and completed the on-site phase of their investigation on August 30, 2000. The final report was submitted to the DOE ORO Manager on October 6, 2000. The scope of the Board's investigation was to review and analyze the circumstances of the accident to determine its causes. The Board also evaluated the adequacy of the safety management system and work control practices of UT-Battelle and BJC as they relate to the accident.

The purpose of this investigation was to determine the cause(s) of the accident, identify lessons learned, improve safety, and reduce the potential for similar accidents.

The Board conducted their investigation using the following methodology:

- Inspecting and photographing the accident scene and individual items of evidence related to the accident.

- Gathering facts through interviews, document and evidence reviews, and a walkdown of the area.

- Charting causal factors related to the five core functions and eight guiding principles of Integrated Safety Management (ISM), along with barrier

and change analysis techniques. (see Accident Analysis Terminology box).

- Developing Judgments of Need for corrective actions to prevent recurrence, based on analysis of the information gathered.

Accident Analysis Terminology

A **causal factor** is an event or condition in the accident sequence that contributes to the unwanted result. There are three types of causal factors: direct cause, which is the immediate event(s) or conditions(s) that caused the accident; contributing causes, which are causal factors that collectively with other causes increase the likelihood of an accident, but that individually did not cause the accident; root cause(s), which is (are) the causal factor(s) that, if corrected, would prevent recurrence of the accident. The causal factors and events of this accident were examined and categorized within the five core functions and eight guiding principles of ISM.

Barrier analysis reviews hazards, the targets (people or objects) of the hazards, and the controls or barriers that management systems put in place to separate the hazards from the targets. Barriers may be physical, administrative, or supervisory.

Change analysis is a systematic approach that examines planned or unplanned changes in a system that caused undesirable results related to the accident.

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